

POWER LINE UNDERGROUNDING PROGRAM OVERVIEW

October 21, 2013



Project Plan

- The construction of underground facilities will be facilitated through a joint effort between Pepco and the District of Columbia Government.
- Undergrounding existing overhead wires reduces outages associated with major storms and improves grid resiliency .
- The project consists of the conversion of approximately 60 overhead constructed feeders to underground construction during the next seven years.



Selection Criteria for Undergrounding Power Lines

- The Technical Committee developed both primary and secondary criteria to aid in analysis and the selection of feeders;
 - Primary Selection Criteria –
 - Past reliability performance ;
 - Analysis of the reliability improvement that can be achieved when undergrounded.
 - Secondary Selection Criteria –
 - Coordination with future economic and infrastructure developments;
 - Coordination with other utilities' and governments' infrastructure projects;
 - Limit the level of construction being performed at any one time within a Ward;
 - Consideration of the number of customers served by each feeder.

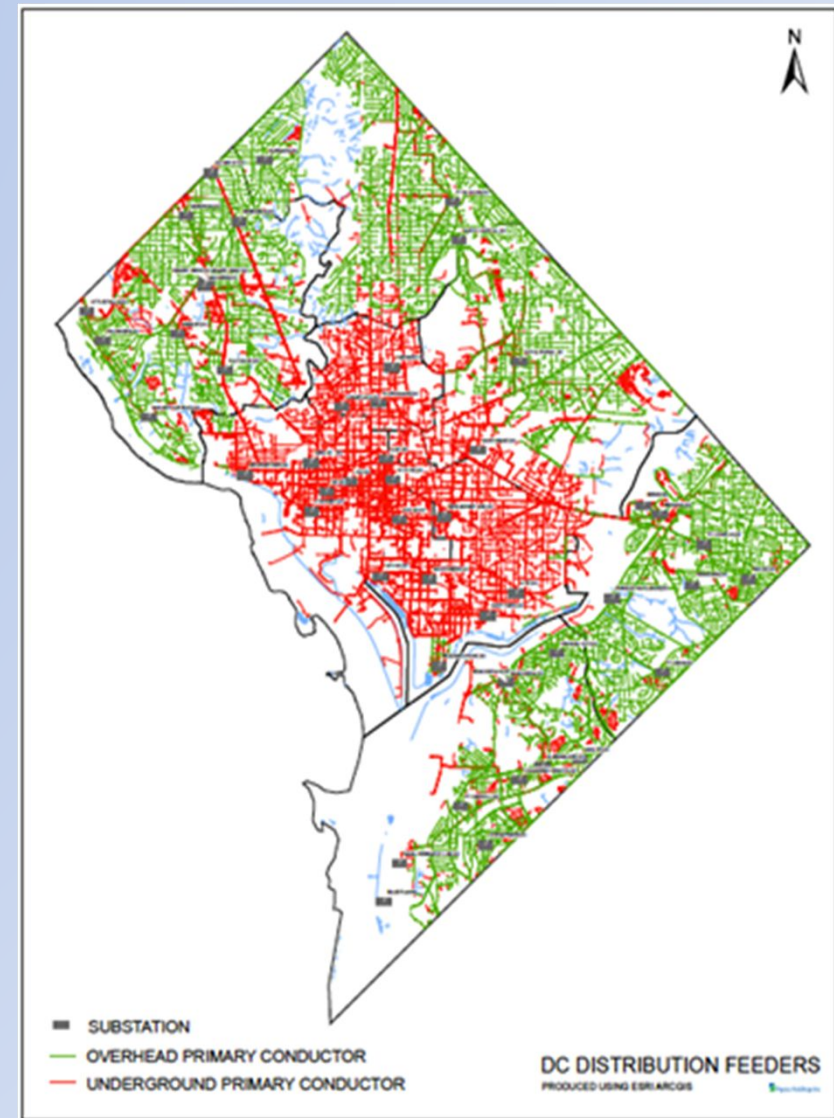
**MAYOR'S POWER LINE UNDERGROUNDING TASK FORCE
TECHNICAL COMMITTEE**

The existing overhead electric system is located across Wards 3,4,7,8 and part of 5

Wards 1,2,6 and part of 5 have always been required to be underground construction

Majority of electric lines supply customers that are connected to both overhead and underground wires

Transfer of overhead lines to underground will benefit all customers



For the District of Columbia, there are fundamentally five different options for undertaking the process of undergrounding power lines:

Scenario 1: Underground the overhead three phase primary mainlines retaining existing overhead transformers, secondary and service poles and overhead laterals;

Scenario 2: Underground the primary laterals including secondary and services. Replace overhead pole mounted transformers with padmount transformers;

Scenario 3: Underground primary mainline and laterals. Replace overhead pole mounted transformers with padmount transformers. Leave existing overhead secondary and services;

Recommendation

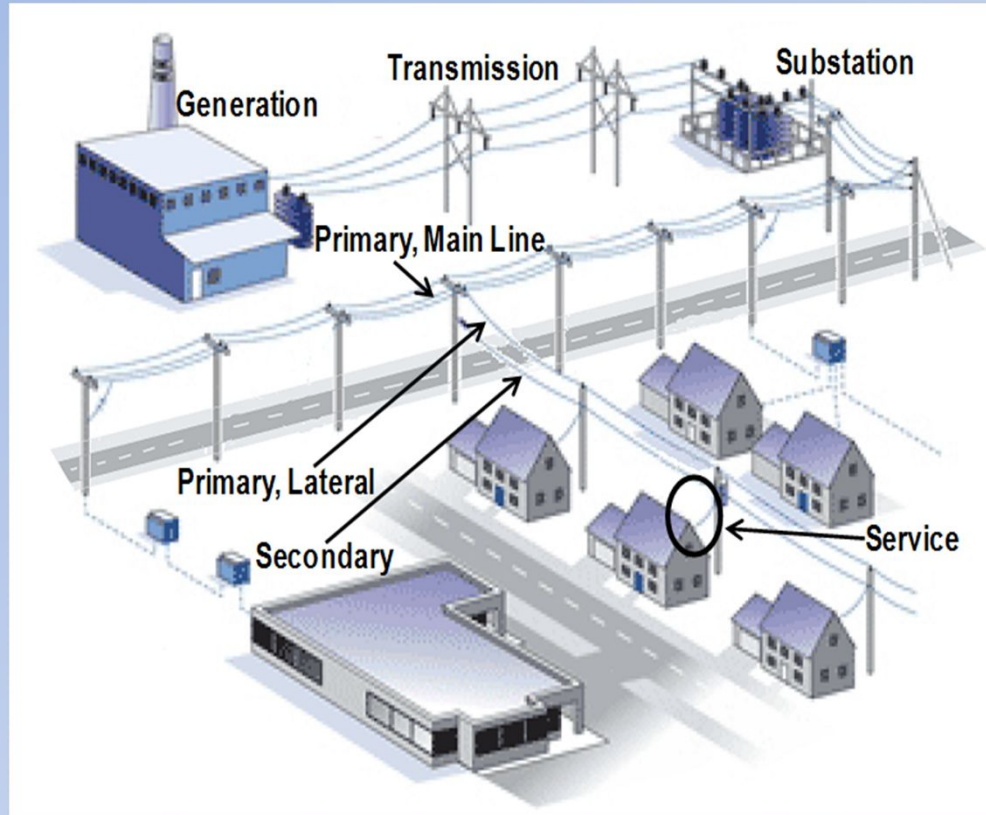
Scenario 4: Underground all primary mainline and laterals, transformers, secondary, and services up to the service delivery point;

Scenario 5: Underground the primary laterals, retaining existing overhead mainline, secondary and services. Replace overhead pole mounted transformers with padmount transformers.



Recommended Undergrounding Scenario

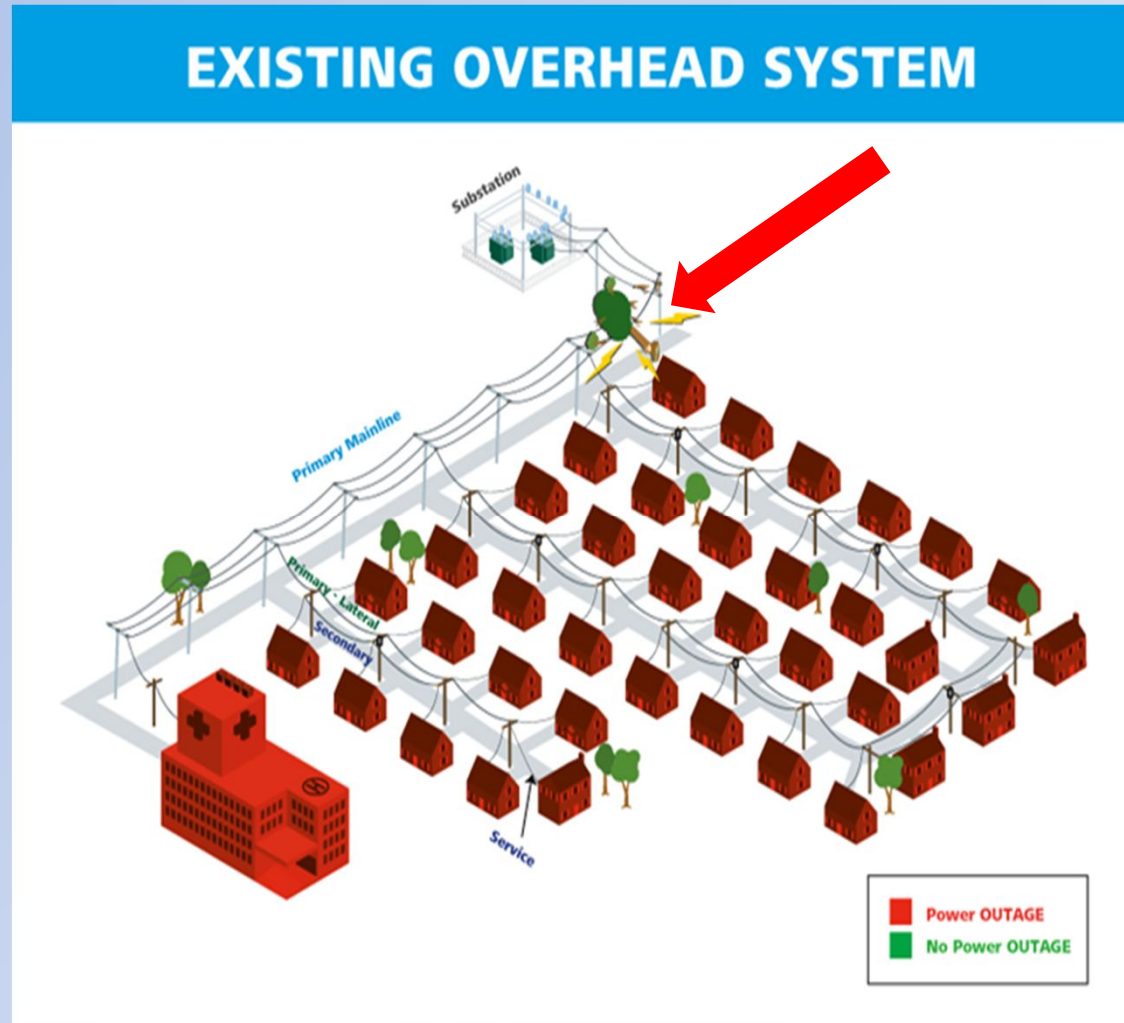
Underground High Voltage Mainline and Laterals Retain Secondary Overhead



- This scenario would eliminate the majority of overhead causes of outages ;
- Eliminates outages that occur on blue sky days, normal storm days or during major storms;
- All high voltage lines , switches, transformers and equipment will be removed form the poles after transfer;



- Graphic to the right is a depiction of the current overhead system in the District;
- When an outage occurs – for example due to a tree falling on a power line – then all customers connected to that line are impacted and lose power;
- Those customers without power must wait until repairs are made and the feeder is restored.



- The recommended scenario has the best balance between cost and reliability improvement;
- If an outage does occur it will only impact a few customers not everyone on the feeder;
- By eliminating the larger outages on the primary wires crews will be able to respond faster to the individual outages that in the past were the last to be restore.
- An initial program over the next 5 to 7 years could provide benefits to over 60,000 customers.



Evaluation of Undergrounding Scenarios

District of Columbia (All Outages Percent of overhead)	Cost (\$Billions)*	Customer Frequency (SAIFI)	Customer Duration (SAIDI)
1. UG main line w/OH secondary	\$1.93	56%	45%
2. UG laterals w/UG secondary	\$3.30	44%	55%
3. UG main line and laterals w/OH secondary	\$3.00	97%	92%
4. UG main line and laterals w/UG secondary	\$5.11	100%	100%
5. UG laterals w/OH secondary	\$1.33	42%	47%

Option 3 (Recommended Scenario)

- Obtains 97% of the benefits at 60% of the cost for the lines undergrounded
- Achieves the goal of reducing outages during major storms in the most cost beneficial method

*The cost identified in the table above represent the cost to underground the entire overhead system for each scenario. The recommendation is to complete approximately one third of this cost in this phase of the project (\$1 billion).

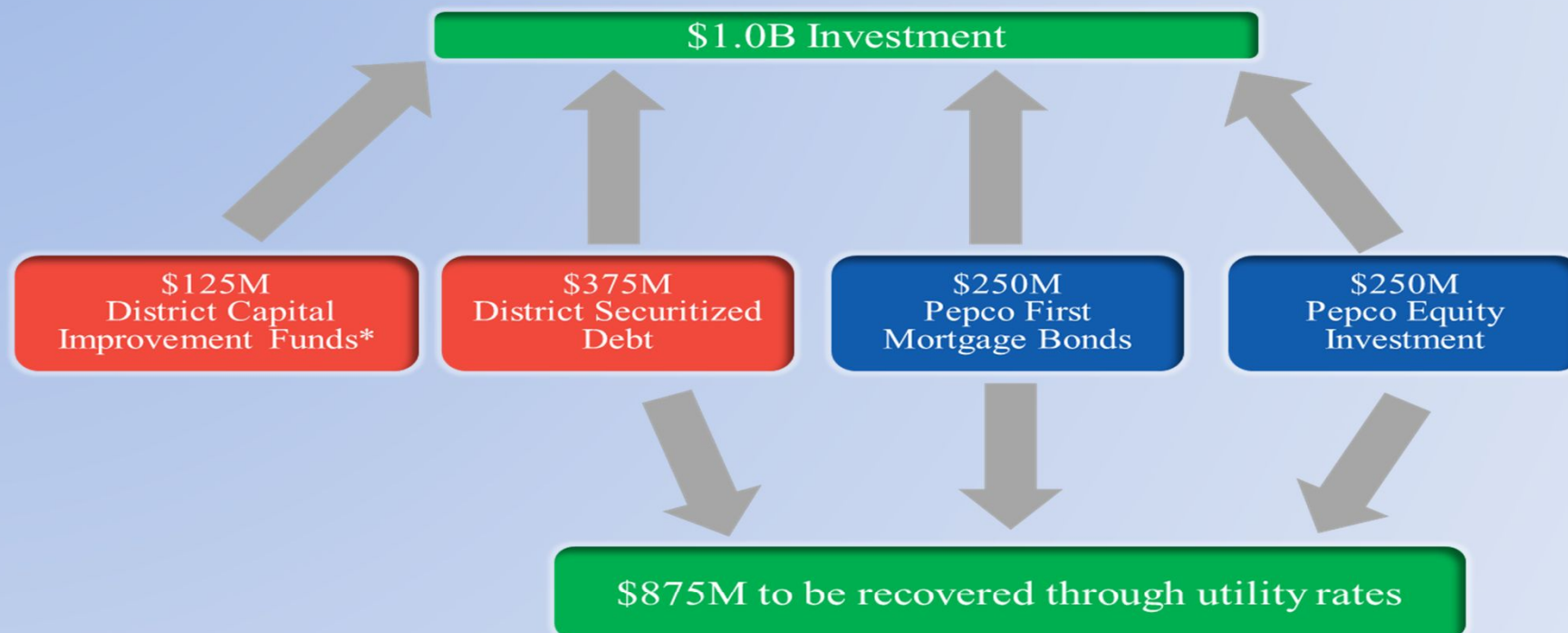


DDOT & Pepco Roles and Responsibilities

- DDOT will issue all contracts to design and build conduit within the public roadway for identified underground projects in conjunction with road projects.
- Pepco will develop design requirements of underground facilities and install all electrical equipment and cables.
- DDOT will transfer ownership of the conduit to Pepco.
- Pepco will be responsible for all ongoing operation and maintenance of the conduit system.



Proposed Financing Structure



Monthly Average Residential Customer Bill Impact**		
<u>Year 1</u>	<u>Year 7</u>	<u>Year 15</u>
\$1.50	\$3.25	\$1.41

* Subject to budget approval

** Excludes RAD customers

Public Service Commission

- Issue Financing order and other orders to establish cost recovery mechanisms
- Approve Underground Infrastructure Improvement Projects Plan including selection of feeders, priority order of work and estimated cost
- Approve annual adjustment of the customer surcharge for:
 - Securitized Bonds Repayment and
 - Pepco's Underground Infrastructure Improvement Projects Plan Costs.
- Approve annual adjustment of the customer surcharge:
 - To insure that the annual surcharge revenues are adequate to cover bond repayment obligations.
 - To adjust the customer surcharge for actual costs incurred by Pepco compared with the projected costs when the Projects Plan was approved by the Commission, and
 - To account for the projected costs for the next year's Projects Plan.



Appendix



**MAYOR'S POWER LINE UNDERGROUNDING TASK FORCE
TECHNICAL COMMITTEE**

District of Columbia's Electric System

Number of Substations	UG feed	OH feed	Total
Distribution	36	15	51
Transmission	7	0	7
Total	43	15	58
Circuit Miles	UG	OH	Total
Primary (4 and 13kV class)	1,699 miles (72%)	645 miles (28%)	2,344 miles
Secondary (120/240, 120/208)	937 miles (54%)	788 miles (46%)	1,725 miles
Totals	2,636 miles (65%)	1,433 miles (35%)	4,069 miles

Customers by feeder	4kV	13kV	Total	% of Total	Customers by Service	Total	% of Total
>=85% Overhead	27,742	28,495	56,237	22%	Overhead	101,737	40%
100% Underground	10,168	104,964	115,132	35%	Underground	154,908	60%
Mixed	10,008	75,048	85,056	43%	Total	256,745	100%
Total	47,918	208,507	256,425	100%			

As an example if you use the option to underground all of the primary and retain the secondary overhead what are some of the impacts ?

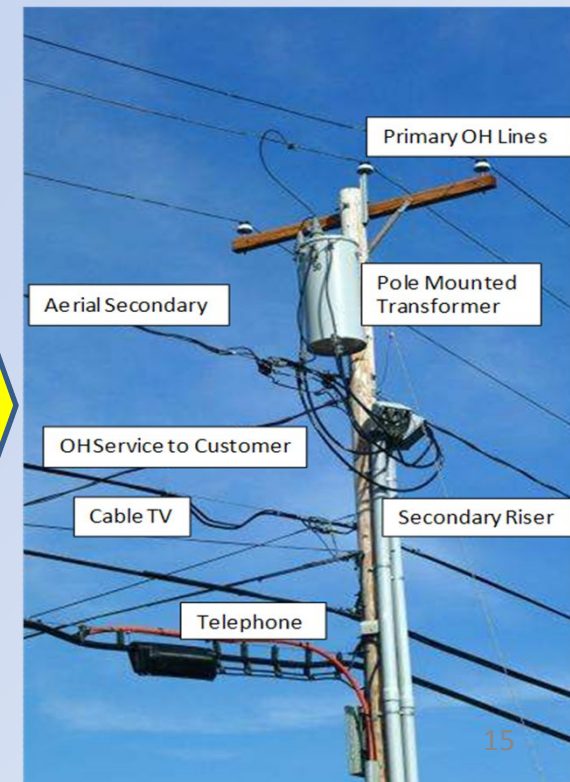
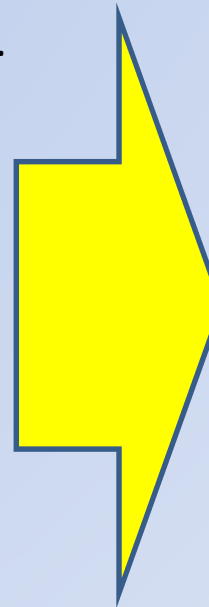
- Selection of undergrounding of primary but not the secondary reduces cost from \$5.11 billion (*ALL overhead electric lines*) to \$3 billion (*ALL primary and lateral electric lines, versus the most vulnerable of those lines*) and still achieves the majority of the reliability benefits – 65% fewer outages, 97% improvement in frequency and 92% reduction in duration of outages
- Retaining secondary and services overhead maintains the need for poles and therefore no driver to underground communication lines
- Avoids the cost and inconvenience of replacing the service drop to customers homes.

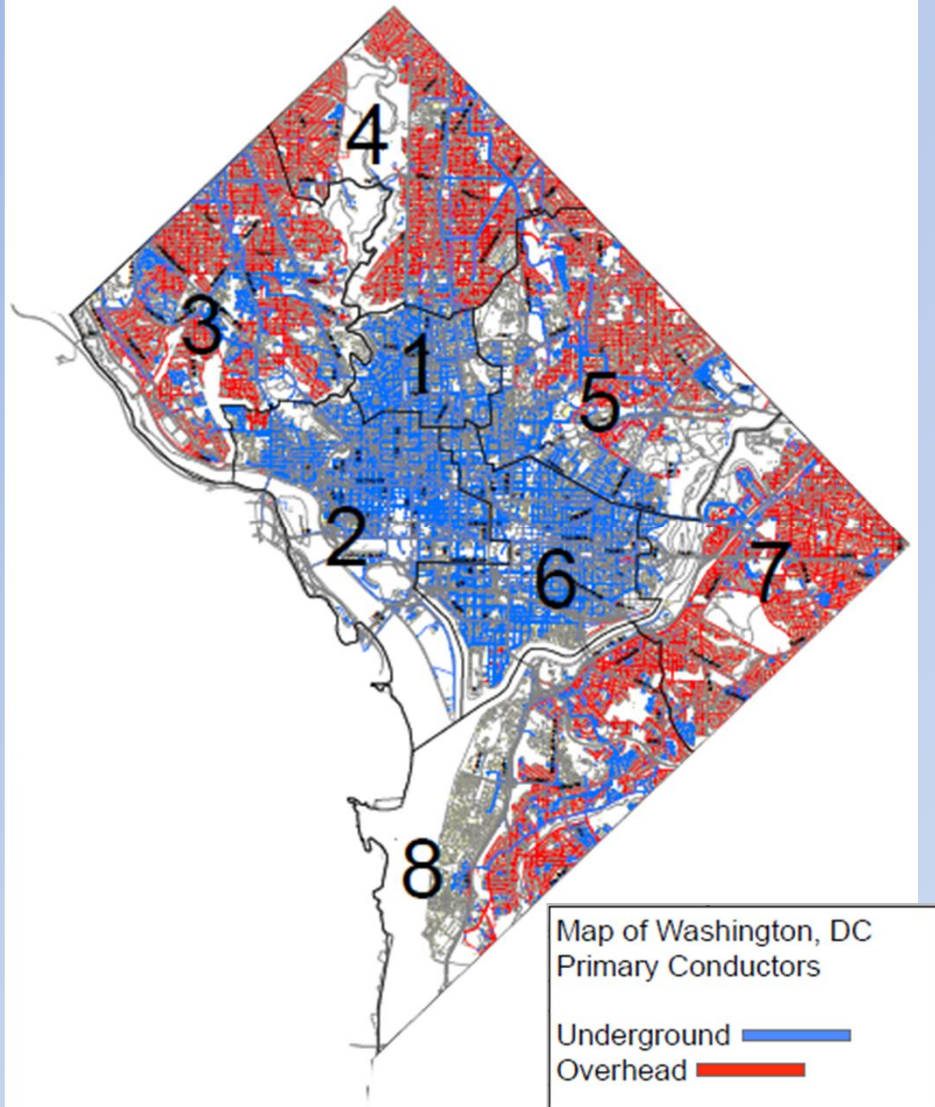
What is removed

Primary OH Lines
Pole Mounted transformer

What remains

Aerial Secondary
OH Service to Customer
Cable TV
Telephone
Secondary Riser





Pepco DC System

- 1,433 miles of overhead lines (35%)
- 2,636 miles of underground lines (65%)
- 60% of customers are served by underground service
- 40% of customers are served by overhead service

Customers by Feeder

- 35% of customers are on 100% underground feeders
- 22% of customers are on feeders that are $\geq 85\%$ underground
- 43% of customers are on mixed feeders

District of Columbia Feeder Outages During Major Storms

